

**Addendum to
REMEDIAL ACTION PLAN**

**DP&L Transportation Center
1900 Dryden Road
Dayton, Montgomery County, Ohio**

Submitted To:

**Division of State Fire Marshal
Bureau of Underground Storage Tanks
8895 East Main Street, P.O. Box 687
Reynoldsburg, Ohio 43068**

**RECEIVED
2002 AUG -6 AM 9:51
STATE FIRE MARSHAL**

Prepared For:

**Dayton Power & Light
P.O. Box 8825
Dayton, Ohio 45401**

August 1, 2002

Prepared By:

**LJB, INC.
3100 Research Park Boulevard
P.O. Box 20246
Dayton, Ohio 45420-0246**

(Project No. EN-16807.A4)

TABLE OF CONTENTS

- 1 INTRODUCTION**
- 2 ASSESSMENT ACTIVITIES**
 - 2.1 Survey of Monitoring Wells
 - 2.2 Groundwater Sampling
 - 2.3 Groundwater Elevations and Flow Direction
- 3 CRITERIA ASSESSMENT**
 - 3.1 Groundwater Velocity Evaluation
 - 3.2 Iron and pH Evaluation
 - 3.3 Carbon and Oxygen Evaluation
 - 3.4 Microbial Nutrient Requirements
 - 3.5 Injection/Monitoring Well Placement
 - 3.6 System Effectiveness
- 4 SYSTEM SPECIFICATIONS, RAP MODIFICATIONS AND MONITORING REQUIREMENTS**
- 5 CONCLUSIONS**

INDEX TO TABLES

- Table 1: Groundwater Elevations (01/17/01)
- Table 2: Revised Hydraulic Conductivity Values
- Table 3: Groundwater Analytical Results (01/17/01)
- Table 4: RAP Implementation Schedule (Months 1 through 14)

INDEX TO FIGURES

- Figure 1: Site Location Map
- Figure 2: Groundwater Contour Map (01/17/01)
- Figure 3: Remediation System Design (Site Layout)
- Figure 4: Remediation System Design (System Layout Specifications)

APPENDICES

- A Analytical Laboratory Report (01/17/01)
- B BTEX Isopleth Map and Volume Computations

1.0

INTRODUCTION

The following document is an Addendum to the Remedial Action Plan (RAP). The RAP was submitted on behalf of The Dayton Power & Light (DP&L) Company on January 8, 2001. The RAP was developed by LJB Inc. (LJB) for the DP&L Transportation Center (Site) located at 1900 Dryden Road in the City of Dayton, Montgomery County, Ohio (see Figure 1). The RAP was developed in response to the written correspondence issued by the Bureau of Underground Storage Tank Regulations (BUSTR) in November 1999. BUSTR requested that DP&L continue "active" remedial activities at the Site, either by continuing the then present "pump and treat" system or by instituting a different treatment approach to achieve site closure.

The purpose of this RAP Addendum is to:

- ◆ Respond to BUSTR's April 18, 2002 request for additional information.
- ◆ Document the results of the January 17, 2001 groundwater-sampling event.
- ◆ Document that the proposed in-situ bioremedial system meets the design criteria specified in: "How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites: A Guide for Corrective Action Plan Reviewers, Chapter X, In-Situ Groundwater Bioremediation" 1995 (EPA 510-B-95-007).
- ◆ Estimate the time necessary to complete bioremediation of the Site.
- ◆ Provide additional specifications not provided in the RAP.

2.0

ASSESSMENT ACTIVITIES

2.1

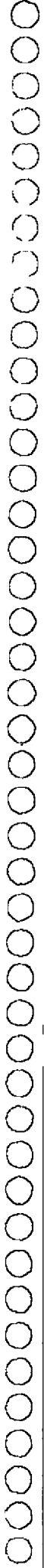
Survey of Monitoring Wells

Existing Site monitoring wells were located by LJB and the well locations/elevations were surveyed. The spatial locations of the wells were determined and top-of-casing elevations measured to +/- 0.01 ft.

2.2

Groundwater Sampling

On January 17, 2001, LJB personnel collected groundwater samples from eight wells on the property. The monitoring wells sampled included MW-2, GW-1, GW-2, GW-4, GW-5, GW-6, GW-7 and GW-8. The intent of this sampling was to collect additional analytical data associated with the contamination plume that was necessary to support the selected remedial alternative, bioremediation. The groundwater samples were analyzed for benzene (B), toluene (T), ethylbenzene (E), total xylenes (X), total organic carbon (TOC), total suspended solids (TSS), dissolved iron, dissolved ammonia, and dissolved orthophosphate. Dissolved oxygen (DO) and pH were measured in the field.



Five well volumes of water were purged from each well prior to sampling using a decontaminated bailer. The same decontaminated bailer used to purge the wells was used to collect the groundwater samples. Each groundwater sample was placed in a precleaned laboratory-supplied sample bottle and temporarily stored in an ice-filled cooler. Upon completion of the sampling activities, the groundwater samples were transported under chain-of-custody requirements to Test America Laboratories in Dayton, Ohio for analysis.

2.3 Groundwater Elevations and Flow Direction

Table 1 includes the groundwater elevations measured on January 17, 2001. Based on the survey results and the measured water levels, LJB determined the groundwater elevations at the Site relative to Mean Sea Level (MSL). Based on the groundwater elevations, the direction of groundwater flow was determined to be consistent with previous monitoring events and was to the southwest (see Figure 2).

3.0 CRITERIA ASSESSMENT

3.1 Groundwater Velocity Evaluation

The velocity of groundwater movement is an important consideration for a bioremediation system. If the groundwater movement is too slow, the injected nutrients/oxygen may be localized around the injection area and may not be effective in remediating the petroleum contamination. Based on EPA 510-B-95-007, the hydraulic conductivity of an aquifer should be at least 0.28 ft/day or greater for an in-situ bioremedial system to be effective.

To determine if the hydraulic conductivity of the Site aquifer will be a limiting factor of the proposed bioremediation system, LJB reviewed previously collected groundwater flow data. Slug tests had been conducted at the Site by SCS Engineers to estimate the field hydraulic conductivity of the uppermost portion of the shallow aquifer. The results of the slug tests were presented in the 1990 Corrective Action Plan. The hydraulic conductivity values in the 1990 Corrective Action Plan were estimated based on the results of these slug tests.

LJB conducted a review of the slug test data presented in the 1990 Corrective Action Plan. This review identified errors in the application of the Bouwer-Rice Method for Slug Test Solutions. Revised hydraulic conductivity values per LJB evaluation of the original slug test data are shown in Table 2. Based on these revised data, the average hydraulic conductivity value was determined to be 75 ft/day.

The calculated average hydraulic conductivity of 75 ft/day is over 250 times greater than the minimum design criteria of 0.28 ft/day and easily meets the EPA suggested



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requirements for this parameter. The Site's average groundwater velocity was calculated to be 57 ft/year in the impacted aquifer zone. This groundwater velocity is based on the average hydraulic conductivity value of 75 ft/day, an average hydraulic gradient of 5.2×10^{-4} (as found on January 17, 2001 – see Figure 2) and an average porosity of 0.25 for a sandy gravel aquifer ("Water in Environmental Planning" by T. Dunne and L. B. Leopold, 1978).

3.2 Iron and pH Evaluation

The analytical data from the January 17, 2001 sampling event is included in Appendix A and summarized in Table 3. Per Table 3, the average pH value was 6.68 and all measurements of dissolved iron were below detection limits. The EPA document indicates that the design criteria for pH should be between 6 to 8 and the dissolved iron concentration should be less than 10 mg/l. The rationale for these criteria is that 1) elevated iron levels in the groundwater could precipitate out when oxygen is added and reduce the permeability of the aquifer and 2) extreme pH values are generally unfavorable for microbial activity. Based on the analytical results, both of these parameters are within the acceptable range of the design criteria for the proposed bioremedial system.

3.3 Carbon and Oxygen Evaluation

Although the site conditions meet the before-mentioned EPA 510-B-95-007 design criteria, the length of time necessary for the system to remediate the impacted groundwater is also an important consideration. The following is the process LJB used to estimate the length of time required to complete the remedial activities at the Site.

The concentration of bioremedial organic material was estimated using the sum of the groundwater BTEX concentrations at each well (see Table 3). The average concentration across the impacted aquifer zone was determined using a Volume Krig Estimate Model. The results of this model (BTEX Isopleth Map and Volume Computations) are included in Appendix B.

Per the volume computations in Appendix B, the average concentration of bioremedial material was determined to be 515 ppb. This concentration was then used as a conservative estimate of the concentration of bioremedial material in the impacted shallow aquifer soil, given that:

- ♦ Benzene is the only parameter in excess of the site action levels, and
- ♦ The soil data collected in 1990 showed the highest concentration in GW-1 where the sum of readily bioremedial organic material (i.e. BTEX) was 515 ppb in the zone between 28 to 30 feet below ground surface.



The weight of organic carbon associated with the bioremedial material was estimated using the following equation:

$$\text{Weight of C} = [(\text{BTEX conc.}) * (\text{Volume of saturated soil}) * (\text{Conversion factor of carbon in gasoline}) * (\text{Porosity of saturated zone}) * (\text{Unit conversion factor of lbs/ft}^3)].$$

Where: BTEX conc. = 515 ppb
Volume of saturated soil is estimated to be 75-ft wide by 80-ft long and 10-ft deep per model results presented in Appendix B
Conversion factor of carbon in gasoline = 0.85 (per J. Matson, www.voicesweb.org/voices/sn/CO2.html)
Porosity of saturated zone = 0.25
Unit conversion factor of lbs/ft³ = 62.4

$$\begin{aligned}\text{Weight of C} &= [(515 * 10^{-9}) * (75 * 80 * 10) * 0.85 * 0.25 * 62.4] \\ &= 0.41 \text{ lbs.}\end{aligned}$$

Per EPA 510-B-95-007, three lbs. of oxygen are required to remediate one pound of carbon. Based on the equation above, $3.0 * 0.41 \text{ lbs.} = 1.2 \text{ lbs.}$ of oxygen are needed to remediate the petroleum-impacted zone at the Site.

Saturation of dissolved oxygen at the Site (based on elevation, water temperature and average barometric pressure) is estimated to be 11 ppm. This level of DO potentially will be generated by the air injection system of the proposed bioremedial system. The weight of DO under saturated conditions is defined using the following equation:

$$\text{Weight of DO} = [(\text{DO conc.}) * (\text{Volume of saturated soil}) * (\text{Porosity of saturated zone}) * (\text{Conversion factor of lbs/ft}^3)]$$

Where: DO conc. = 11 ppm
Volume of saturated soil = 75-ft wide*80-ft long*10-ft deep
Porosity of saturated zone = 0.25
Conversion factor of lbs/ft³ = 62.4

$$\begin{aligned}\text{Weight of DO} &= (11 * 10^{-6}) * (75 * 80 * 10) * 0.25 * 62.4 \\ &= 10.3 \text{ lbs.}\end{aligned}$$

Based on the above equations, 10.3 lbs. of dissolved oxygen will be available across the site once DO saturation exists. Given that 10.3 lbs. of dissolved oxygen is well in excess of the 1.2 lbs. of dissolved oxygen necessary to complete bioremediation, groundwater travel time and microbial growth rates then become the limiting factors for completing the remedial activities at the Site as long as adequate nutrients are provided.



3.4 Microbial Nutrient Requirements

Soil normally contains large numbers of microbial organisms, particularly bacteria, which contribute significantly to the in-situ bioremedial processes as long as their nutrient needs are met. These nutrient needs include 1) carbon – as an energy source; 2) nitrogen and phosphate – to support cell growth; and 3) terminal electron acceptors – injected air to support cell growth and oxidize the carbon source into carbon dioxide.

The nutrient requirements for the biodegradation process can be simplified as a carbon: nitrogen: phosphorus ratio. Per EPA 510-B-95-007 design criteria, the in-situ ratio should fall between 100:1.0:0.5 and 100:10:1. Although this ratio will not remain constant through time as the bacteria consume the carbon food source and modify the chemical composition of the impacted groundwater, LJB will maintain the optimized levels through periodic monitoring activities of the groundwater at the Site and adjust the nutrient levels in the injection wells.

3.5 Injection/Monitoring Well Placement

The proper construction/location of both the injection wells and monitoring wells are critical components for both inducing bioremediation and being able to monitor the performance of the treatment system. Per the EPA 510-B-95-007 design criteria, a minimum of one to three injection wells are needed for an effective bioremedial system. However, the exact number of wells will be dependent upon the distance the injected airflow can be induced to cause bioremediation (i.e. defined as the bubble radius). This factor is primarily controlled by the hydraulic conductivity of the contaminated aquifer. However, variations in the vertical and horizontal permeability of the soil can impact the site-specific bubble radius.

EPA 510-B-95-007 suggests a design bubble radius of 5 for fine-grained soils to 100 for coarse-grained soils. Review of the hydraulic conductivity data indicates that the site soils have an intermediate grain size so that a bubble radius of 25 feet is appropriate. A bubble radius of 25 feet using three injection wells traversing the plume (i.e. GW-1, GW-4 and MW-2) should be sufficient to supply the oxygen needs of the bioremedial system.

Per EPA 510-B-95-007 design criteria, at least three monitoring wells surrounding the plume should exit and be screened across the impacted zone. Based on this requirement, wells GW-5, GW-6, GW-7 and GW-8 are required to properly monitor the performance of the treatment system across the lateral extent of the plume.



3.6 System Effectiveness

The proper conditions for complete bioremediation should be in place as the DO saturated water (with optimized nutrient levels) travels across the 80-ft long impacted zone. With a calculated groundwater flow rate of 57 ft/year, saturated DO conditions should occur within approximately 1.5 years in the impacted zone.

Once oxygen and the nutrients are not the limiting factors, only a small amount of additional time should be required for the bacteria to complete the remediation of the petroleum materials.

4.0 SYSTEM SPECIFICATIONS, RAP MODIFICATIONS AND MONITORING REQUIREMENTS

The configuration and the specifications of the bioremedial system are shown in Figures 3 and 4. All materials excavated during the installation of the bioremedial system will be treated and disposed of per applicable OEPA requirements.

LJB proposes to periodically monitor the performance of the groundwater treatment system in order to collect the data needed to measure the progress of the remediation. The groundwater data will also be used to periodically modify and optimize the levels of the injected nutrients. In the original RAP, monitoring wells GW-1, MW-2 GW-4, GW-5 and GW-6 were proposed as the injection wells. Based on the findings presented in Section 3.5 and because no monitoring wells were located between the injection system and the property boundary, wells GW-5 and GW-6 will not be used as injection wells but will be used along with GW-7 and GW-8 as monitoring wells to evaluate the performance of the treatment system.

Prior to the start-up of the treatment system, the groundwater baseline conditions will be determined through sampling both the injection wells and the monitoring wells. The analyses to be conducted to define the baseline conditions will include DO, TOC, TSS, pH, dissolved iron, ammonia, orthophosphates, benzene, ethylbenzene, toluene and total xylenes.

Groundwater conditions will be monitored on a quarterly basis for the same parameters identified above, but only at monitoring wells GW-5, GW-6, GW-7 and GW-8. The analytical results from the groundwater monitoring events will be compared to the Site action levels. These levels were identified in the 1990 Corrective Action Plan and are as follows: 5 ppb for benzene, 2,000 ppb for toluene, 700 ppb for ethylbenzene and 10,000 ppb for total xylenes. Once these action levels have been meet, LJB will

submit a completion report to BUSTR and request a No Further Action Status for the Site.

LJB will evaluate the performance of the treatment system at least every quarter and will present its findings/data to BUSTR in Quarterly Reports. As needed, LJB will request any necessary modifications to the bioremedial system in these Quarterly Reports. The RAP Implementation Schedule through the first 14 months is provided in Table 4.

5.0 CONCLUSIONS

Based on previous investigations and the January 17, 2001 analytical results, LJB has determined that the proposed bioremediation system meets USEPA design criteria and is an acceptable remedial alternative for the Site. This approach will promote the activity of the petroleum-degrading bacteria present in the soil. Combined with subsurface soil conditions and groundwater flow rates across the impacted area, LJB believes this method is the best treatment alternative for the subject site.

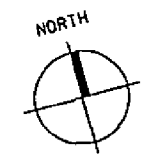
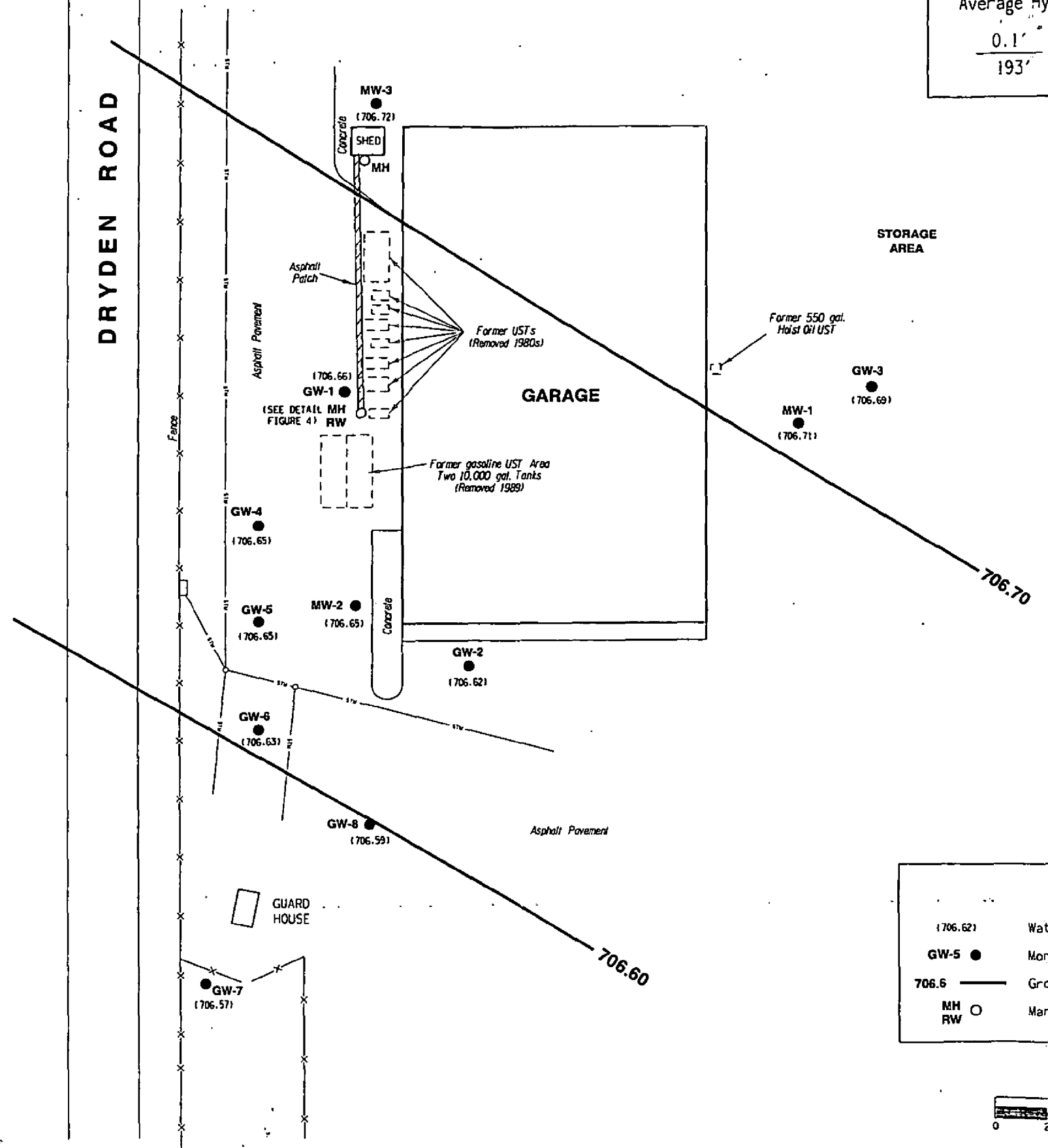
FIGURES

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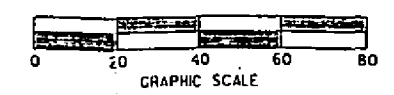
DRYDEN ROAD

Average Hydraulic Gradient
$$\frac{0.1'}{193'} = 5.2 \times 10^{-4}$$



LEGEND

- (706.62) Water Level Elevations (MSL)
- GW-5 ● Monitoring Wells
- 706.6 — Groundwater Isopleths
- MH ○ Manhole at RW



REVISIONS	
NO.	DATE

DAYTON POWER & LIGHT COMPANY
(DRYDEN ROAD SERVICE CENTER)

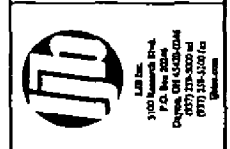
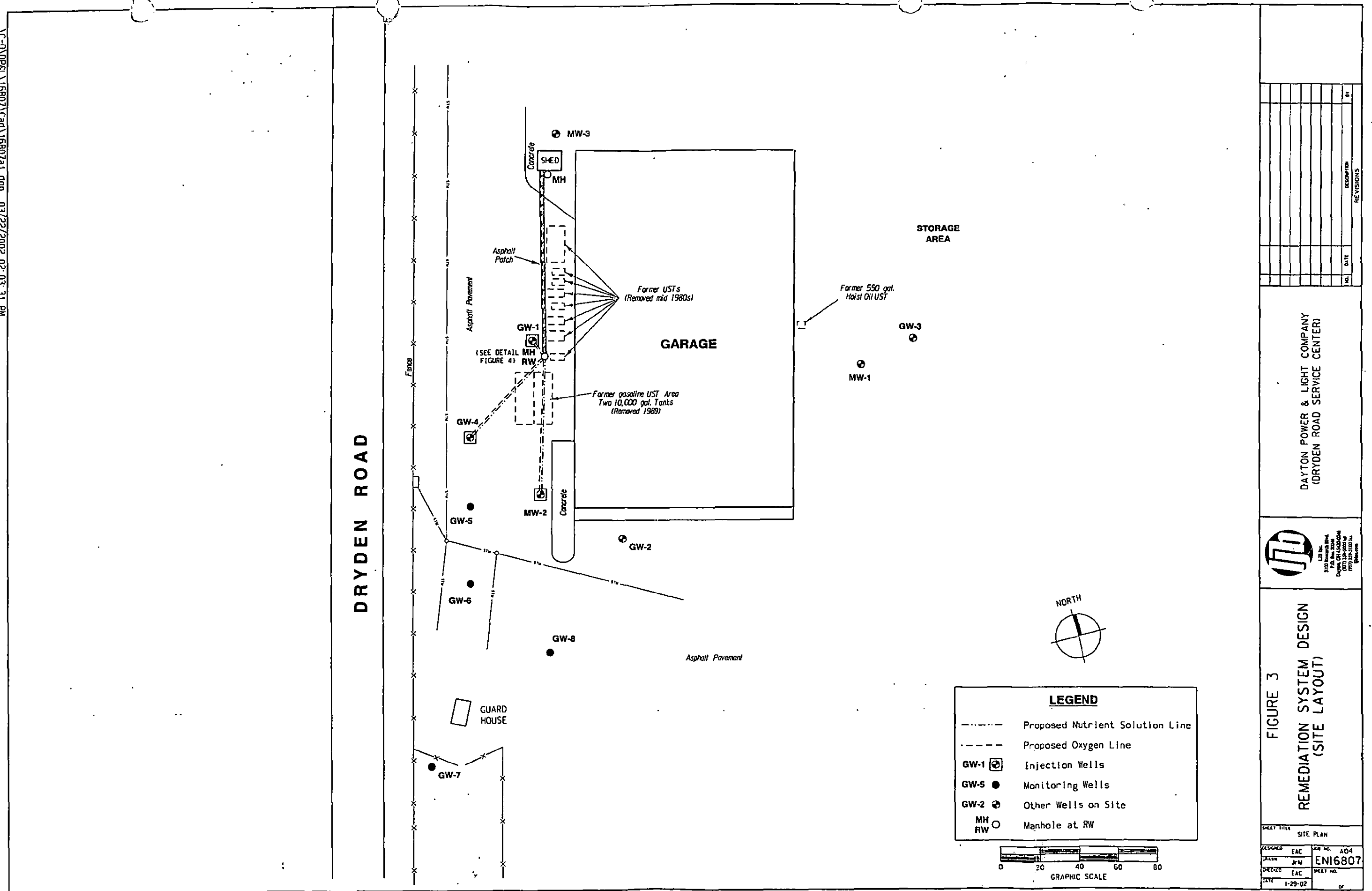
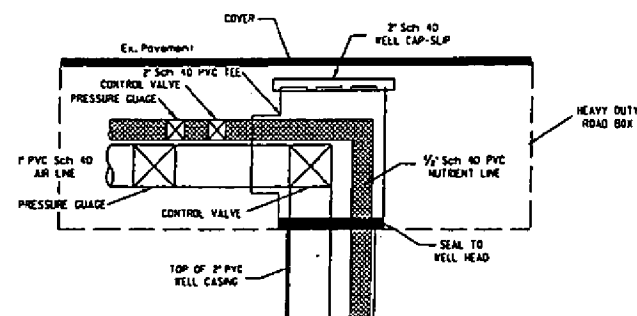


FIGURE 2
GROUNDWATER CONTOUR
MAP (1/17/01)

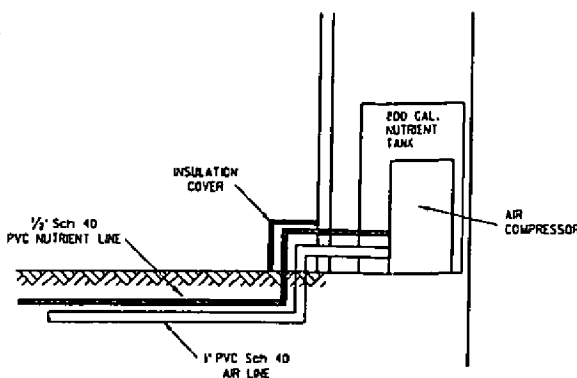
SHEET TITLE	
GROUNDWATER CONTOUR MAP	
DESIGNED	EAC
DRAWN	JFM
CHECKED	EAC
DATE	2-21-02
ACT. NO.	A04
SHEET NO.	EN16807
OF	



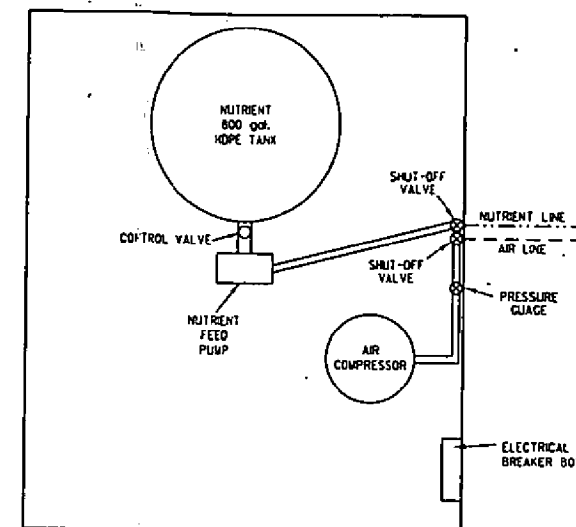
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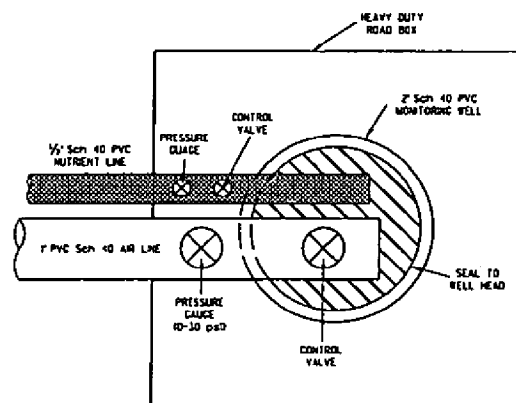
INJECTOR WELL HEAD DESIGN
SIDE VIEW
NOT TO SCALE



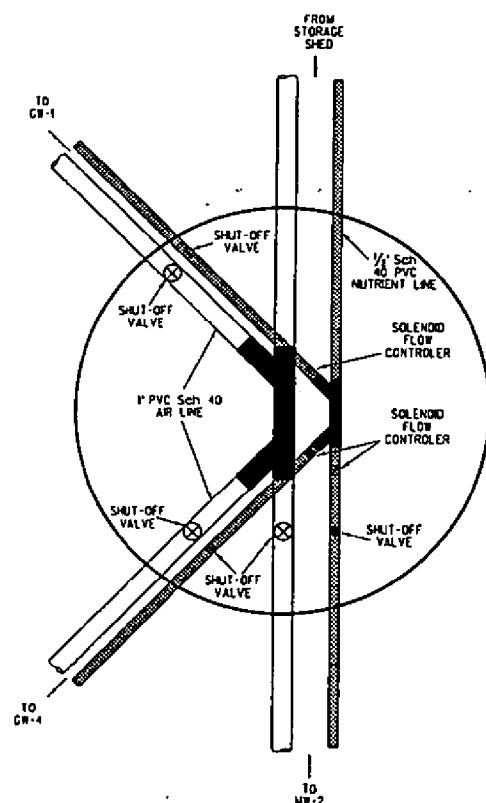
STORAGE AREA ~ SIDE VIEW
NOT TO SCALE



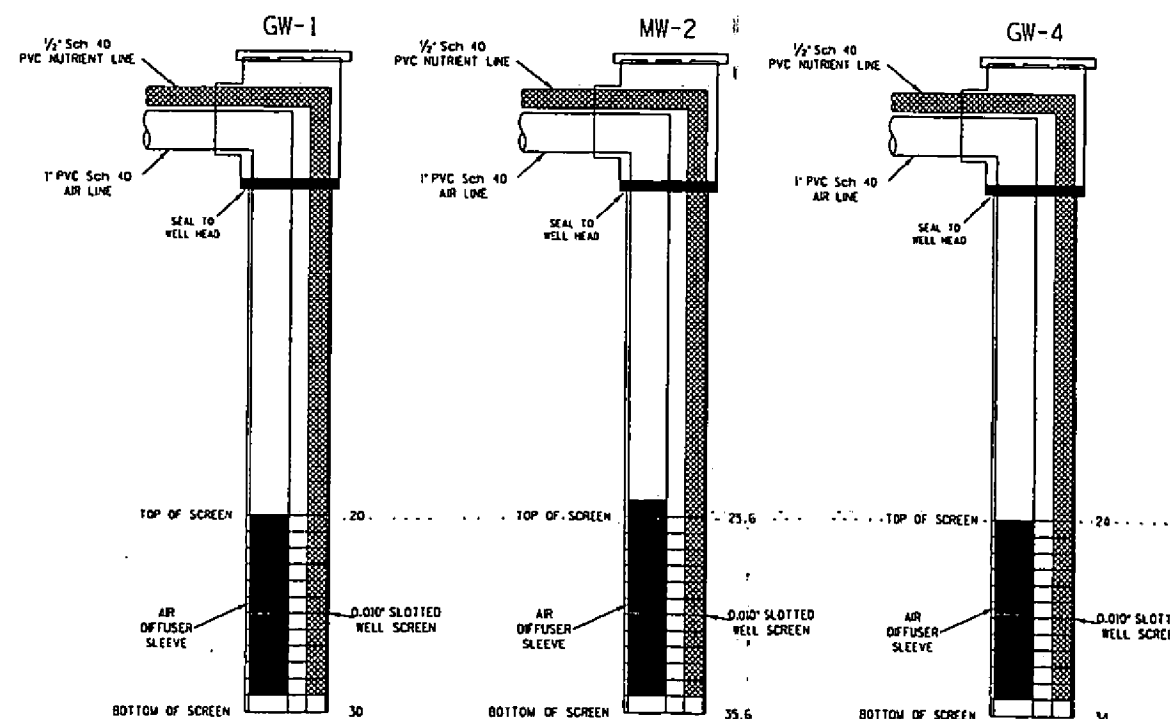
STORAGE SHED ~ TOP VIEW
NOT TO SCALE



INJECTOR WELL HEAD DESIGN
TOP VIEW
NOT TO SCALE



MANHOLE AT RW
NOT TO SCALE



NOTE:
HEAVY DUTY ROAD BOX
TO COVER ALL INJECTION WELLS.

INJECTION WELL DESIGNS
NOT TO SCALE

DAYTON POWER & LIGHT COMPANY
(DRYDEN ROAD SERVICE CENTER)



FIGURE 4
REMEDIATION SYSTEM DESIGN
(SYSTEM LAYOUT SPECIFICATIONS)

SHEET TITLE			
SYSTEM LAYOUT PLAN AND NOTES			
DESIGNED	EAC	APP NO.	A04
DRAWN	JFM	EN16807	
CHECKED	EAC	SHEET NO.	
DATE	2-21-02	OF	

TABLES



Table 1 - Groundwater Elevations (01/17/01)

Well	TOC	Depth to Groundwater	Groundwater Elevations
MW-1	733.31	26.60	706.71
MW-2	733.37	26.72	706.65
MW-3	734.07	27.35	706.72
GW-1	733.34	26.68	706.66
GW-2	733.64	27.02	706.62
GW-3	733.90	27.21	706.69
GW-4	732.56	25.91	706.65
GW-5	732.83	26.18	706.65
GW-6	732.77	26.14	706.63
GW-7	733.24	26.67	706.57
GW-8	733.24	26.65	706.59

TOC - Top of Casing

TOC and Groundwater Elevations are in feet relative to Mean Sea Level

Depth to Groundwater is relative to feet below TOC

Table 2 - Revised Hydraulic Conductivity Values

Well	K value (ft/day)
MW-1	26
MW-2	23
MW-3	8
GW-1	185
GW-2	99
GW-3	109
Average	75

Table 3 – Groundwater Analytical Results (01/17/01)

Parameter Well → ↓	B ug/l	T ug/l	E ug/l	X ug/l	TOTAL BTEX ug/l	TOC mg/l	TSS mg/l	Dissolved Iron mg/l	Ammonia-N (NH ₃ -N) mg/l	Ortho phosphate mg/l	pH S.U.	Dissolved Oxygen mg/l
MW-1	Not sampled for lab analysis										6.50	0.8
MW-2	128	<10	<10	<10	128	15	680	<0.10	0.41	<0.306	6.59	0.6
GW-1	96.5	<10	<10	<10	96.5	7	37	<0.10	0.28	<0.306	6.51	0.6
GW-2	19.6	<1.0	5.5	6.0	31.1	16	580	<0.10	0.26	<0.306	6.79	0.6
GW-3	Not sampled for lab analysis										6.54	0.5
GW-4	60.6	<10	<10	<10	60.6	12	1,190	<0.10	0.48	<0.306	6.51	0.6
GW-5	60	<10	<10	<10	60.0	16	490	<0.10	0.48	<0.306	6.65	0.7
GW-6	889	631	894	4020	6434	78	4,150	<0.10	0.34	<0.306	6.95	0.4
GW-7	<1.0	<1.0	<1.0	<1.0	--	30	5,260	<0.10	0.12	<0.306	6.72	0.6
GW-8	3.1	<1.0	<1.0	<1.0	3.1	8	93	<0.10	0.13	<0.306	7.02	0.6
Average	--	--	--	--	--	23	1560	--	0.31	--	6.68	0.6

S.U. – Standard Units

Table 4 – RAP Implementation Schedule (Months 1 through 14)

Task	Mon. 1	Mon. 2	Mon. 3	Mon. 4	Mon. 5	Mon. 6	Mon. 7	Mon. 8	Mon. 9	Mon. 10	Mon. 11	Mon. 12	Mon. 13	Mon. 14
BUSTR Approval of RAP Addendum	X													
System Installation & Start-Up		X												
Inspections, pH & GW Weekly Measurements		X	X	X	X	X	X	X	X	X	X	X	X	X
Sampling and Analysis Activities		X			X			X			X			X
Quarterly Performance Reports		X			X			X			X			X

APPENDIX A

ANALYTICAL REPORT

Cindy Edgington
LOCKWOOD, JONES & BEALS

01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Enclosed is the analytical report for the following samples submitted to the Dayton Division of TestAmerica, Inc. for analysis:

<u>Sample Number</u>	<u>Sample Description</u>	<u>Date Taken</u>	<u>Date Received</u>
657068	FB-Grab	01/17/2001	01/17/2001
657069	GW-7-Grab	01/17/2001	01/17/2001
657070	GW-8-Grab	01/17/2001	01/17/2001
657071	GW-6-Grab	01/17/2001	01/17/2001
657072	GW-2-Grab	01/17/2001	01/17/2001
657073	MW-2-Grab	01/17/2001	01/17/2001
657074	GW-5-Grab	01/17/2001	01/17/2001
657075	GW-4-Grab	01/17/2001	01/17/2001
657076	GW-1-Grab	01/17/2001	01/17/2001

TestAmerica, Inc. certifies that the analytical results contained herein apply only to the specific samples analyzed.

Reproduction of this analytical report is permitted only in its entirety.

Enclosure


Approved By

ANALYTICAL REPORT

Cindy Edgington
LOCKWOOD, JONES & BEALS

01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Client Project ID: DP&L/Dryden Rd.EN-16807.A4

SAMPLE NO.	SAMPLE DESCRIPTION	Result	Flag	Units	Date Analyzed	Prep	Run	Reporting Limit	Analyst Initials	Method Reference
						Batch Number	Batch Number			
657068	FB-Grab									DATE/TIME TAKEN 01/17/2001 10:20
Nitrogen, Ammonia Direct	<0.05	mg/L			01/22/2001		1138	<0.05	kkh	EPA 350.1
Phosphate, Ortho	<0.306	mg/L			01/19/2001		411	<0.306	cca	SM 4500-P E.
Solids, Suspended	<5	mg/L			01/18/2001		2367	<3	cdc	EPA 160.2
Total Organic Carbon (TOC)	<1	mg/L			01/19/2001		1393	<1	jmg	SM 5310 B.
ICP DISSOLVED METALS	Complete				01/22/2001		527	Complete	rrs	EPA 200.7
Iron, Dissolved, ICP	<0.10	mg/L			01/22/2001		601	<0.10	rrs	EPA 200.7
Sample Filtration	Complete				01/19/2001		305	Complete	emd	
BTEX 8020, AQUEOUS										
Benzene	<1.0	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Ethylbenzene	<1.0	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Toluene	<1.0	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Xylenes, Total	<1.0	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Surrogate: BFB	96	%			01/24/2001		565		meb	SW 8020
657069	GW-7-Grab									DATE/TIME TAKEN 01/17/2001 12:40
Nitrogen, Ammonia Direct	0.12	mg/L			01/23/2001		1139	<0.05	kkh	EPA 350.1
Phosphate, Ortho	<0.306	mg/L			01/19/2001		411	<0.306	cca	SM 4500-P E.
Solids, Suspended	5,260	mg/L			01/18/2001		2367	<3	cdc	EPA 160.2
Total Organic Carbon (TOC)	30	mg/L			01/19/2001		1393	<1	jmg	SM 5310 B.
ICP DISSOLVED METALS	Complete				01/22/2001		527	Complete	rrs	EPA 200.7

ANALYTICAL REPORT

Cindy Edgington
LOCKWOOD, JONES & BEALS

01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Client Project ID: DP&L/Dryden Rd.EN-16807.A4

Result	Flag	Units	Date Analyzed	Prep Batch Number	Run Batch Number	Reporting Limit	Analyst Initials	Method Reference
SAMPLE NO.	SAMPLE DESCRIPTION		DATE/TIME TAKEN					
657069	GW-7-Grab		01/17/2001 12:40					
Iron, Dissolved, ICP	<0.10	mg/L	01/22/2001	601	<0.10	rrs	EPA 200.7	
Sample Filtration	Complete		01/19/2001	305	Complete	emd		
BTEX 8020, AQUEOUS								
Benzene	<1.0	ug/L	01/24/2001	565	<1.0	meb	SW 8020	
Ethylbenzene	<1.0	ug/L	01/24/2001	565	<1.0	meb	SW 8020	
Toluene	<1.0	ug/L	01/24/2001	565	<1.0	meb	SW 8020	
Xylenes, Total	<1.0	ug/L	01/24/2001	565	<1.0	meb	SW 8020	
Surrogate: BFB	89	%	01/24/2001	565		meb	SW 8020	
SAMPLE NO.	SAMPLE DESCRIPTION		DATE/TIME TAKEN					
657070	GW-8-Grab		01/17/2001 12:50					
Nitrogen, Ammonia Direct	0.13	mg/L	01/23/2001	1139	<0.05	kkh	EPA 350.1	
Phosphate, Ortho	<0.306	mg/L	01/19/2001	411	<0.306	cca	SM 4500-P E.	
Solids, Suspended	93	mg/L	01/18/2001	2367	<3	cdc	EPA 160.2	
Total Organic Carbon (TOC)	8	mg/L	01/19/2001	1393	<1	jmg	SM 5310 B.	
ICP DISSOLVED METALS	Complete		01/22/2001	527	Complete	rrs	EPA 200.7	
Iron, Dissolved, ICP	<0.10	mg/L	01/22/2001	601	<0.10	rrs	EPA 200.7	
Sample Filtration	Complete		01/19/2001	305	Complete	emd		
BTEX 8020, AQUEOUS								
Benzene	3.1	ug/L	01/24/2001	565	<1.0	meb	SW 8020	
Ethylbenzene	<1.0	ug/L	01/24/2001	565	<1.0	meb	SW 8020	

ANALYTICAL REPORT

Cindy Edgington
LOCKWOOD, JONES & BEALS

01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Client Project ID: DP&L/Dryden Rd.EN-16807.A4

	Result	Flag	Units	Date Analyzed	Prep Batch Number	Run Batch Number	Reporting Limit	Analyst Initials	Method Reference
SAMPLE NO. 657070	SAMPLE DESCRIPTION GW-8-Grab			DATE/TIME TAKEN 01/17/2001 12:50					
Toluene	<1.0		ug/L	01/24/2001		565	<1.0	meb	SW 8020
Xylenes, Total	<1.0		ug/L	01/24/2001		565	<1.0	meb	SW 8020
Surrogate: BFB	94		%	01/24/2001		565		meb	SW 8020
SAMPLE NO. 657071	SAMPLE DESCRIPTION GW-6-Grab			DATE/TIME TAKEN 01/17/2001 12:10					
Nitrogen, Ammonia Direct	0.34		mg/L	01/23/2001		1139	<0.05	kkh	EPA 350.1
Phosphate, Ortho	<0.306		mg/L	01/19/2001		411	<0.306	cca	SM 4500-P E.
Solids, Suspended	4,150		mg/L	01/18/2001		2367	<3	cdc	EPA 160.2
Total Organic Carbon (TOC)	78		mg/L	01/19/2001		1393	<1	jmg	SM 5310 B.
ICP DISSOLVED METALS	Complete			01/22/2001		527	Complete	rrs	EPA 200.7
Iron, Dissolved, ICP	<0.10		mg/L	01/22/2001		601	<0.10	rrs	EPA 200.7
Sample Filtration	Complete			01/19/2001		305	Complete	emd	
BTEX 8020, AQUEOUS									
Benzene	889		ug/L	01/24/2001		565	<10	meb	SW 8020
Ethylbenzene	894		ug/L	01/24/2001		565	<10	meb	SW 8020
Toluene	631		ug/L	01/24/2001		565	<10	meb	SW 8020
Xylenes, Total	4020		ug/L	01/25/2001		566	<50	meb	SW 8020
Surrogate: BFB	103		%	01/24/2001		565		meb	SW 8020

ANALYTICAL REPORT

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01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Client Project ID: DP&L/Dryden Rd.EN-16807.A4

SAMPLE NO.	SAMPLE DESCRIPTION	Result	Flag	Units	Date	Prep Batch	Run Batch	Reporting Limit	Analyst Initials	Method Reference
					Analyzed	Number	Number			
657072	GW-2-Grab									
										DATE/TIME TAKEN
										01/17/2001 11:40
Nitrogen, Ammonia Direct	0.26	mg/L			01/23/2001		1139	<0.05	kkh	EPA 350.1
Phosphate, Ortho	<0.306	mg/L			01/19/2001		411	<0.306	cca	SM 4500-P E.
Solids, Suspended	580	mg/L			01/18/2001		2367	<3	cdc	EPA 160.2
Total Organic Carbon (TOC)	16	mg/L			01/19/2001		1393	<1	jmg	SM 5310 B.
ICP DISSOLVED METALS	Complete				01/22/2001		527	Complete	rrs	EPA 200.7
Iron, Dissolved, ICP	<0.10	mg/L			01/22/2001		601	<0.10	rrs	EPA 200.7
Sample Filtration	Complete				01/19/2001		305	Complete	emd	
BTEX 8020, AQUEOUS										
Benzene	19.6	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Ethylbenzene	5.5	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Toluene	<1.0	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Xylenes, Total	6.0	ug/L			01/24/2001		565	<1.0	meb	SW 8020
Surrogate: BFB	109	%			01/24/2001		565		meb	SW 8020
657073	MW-2-Grab									
										DATE/TIME TAKEN
										01/17/2001 11:06
Nitrogen, Ammonia Direct	0.41	mg/L			01/23/2001		1139	<0.05	kkh	EPA 350.1
Phosphate, Ortho	<0.306	mg/L			01/19/2001		411	<0.306	cca	SM 4500-P E.
Solids, Suspended	680	mg/L			01/18/2001		2367	<3	cdc	EPA 160.2
Total Organic Carbon (TOC)	15	mg/L			01/19/2001		1393	<1	jmg	SM 5310 B.
ICP DISSOLVED METALS	Complete				01/22/2001		527	Complete	rrs	EPA 200.7

ANALYTICAL REPORT

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01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Client Project ID: DP&L/Dryden Rd.EN-16807.A4

SAMPLE NO.	SAMPLE DESCRIPTION	Result	Flag	Units	Date Analyzed	Prep Batch Number	Run Batch Number	Reporting Limit	Analyst Initials	Method Reference	DATE/TIME TAKEN
657073	MW-2-Grab										01/17/2001 11:06
Iron, Dissolved, ICP		<0.10		mg/L	01/22/2001		601	<0.10	rrs	EPA 200.7	
Sample Filtration		Complete			01/19/2001		305	Complete	emd		
BTEX 8020, AQUEOUS											
Benzene		128		ug/L	01/24/2001		565	<10	meb	SW 8020	
Ethylbenzene		<10		ug/L	01/24/2001		565	<10	meb	SW 8020	
Toluene		<10		ug/L	01/24/2001		565	<10	meb	SW 8020	
Xylenes, Total		<10		ug/L	01/24/2001		565	<10	meb	SW 8020	
Surrogate: BFB		98		%	01/24/2001		565		meb	SW 8020	
657074	GW-5-Grab										01/17/2001 12:20
Nitrogen, Ammonia Direct		0.48		mg/L	01/23/2001		1139	<0.05	kkh	EPA 350.1	
Phosphate, Ortho		<0.306		mg/L	01/19/2001		411	<0.306	cca	SM 4500-P E.	
Solids, Suspended		490		mg/L	01/18/2001		2367	<3	cdc	EPA 160.2	
Total Organic Carbon (TOC)		16		mg/L	01/19/2001		1393	<1	jmg	SM 5310 B.	
ICP DISSOLVED METALS		Complete			01/22/2001		527	Complete	rrs	EPA 200.7	
Iron, Dissolved, ICP		<0.10		mg/L	01/22/2001		601	<0.10	rrs	EPA 200.7	
Sample Filtration		Complete			01/19/2001		305	Complete	emd		
BTEX 8020, AQUEOUS											
Benzene		60.0		ug/L	01/24/2001		565	<10	meb	SW 8020	
Ethylbenzene		<10		ug/L	01/24/2001		565	<10	meb	SW 8020	

ANALYTICAL REPORT

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01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Client Project ID: DP&L/Dryden Rd.EN-16807.A4

SAMPLE NO.	SAMPLE DESCRIPTION	Result	Flag	Units	Date	Prep	Run	Reporting	Analyst	Method Reference	DATE/TIME TAKEN
					Analyzed	Batch	Batch				
657074	GW-5-Grab										01/17/2001 12:20
Toluene		<10		ug/L	01/24/2001		565	<10	mcb	SW 8020	
Xylenes, Total		<10		ug/L	01/24/2001		565	<10	mcb	SW 8020	
Surrogate: BPB		91		%	01/24/2001		565		mcb	SW 8020	
657075	GW-4-Grab										01/17/2001 11:30
Nitrogen, Ammonia Direct		0.48		mg/L	01/23/2001		1139	<0.05	kkh	EPA 350.1	
Phosphate, Ortho		<0.306		mg/L	01/19/2001		411	<0.306	cca	SM 4500-P E.	
Solids, Suspended		1,190		mg/L	01/18/2001		2367	<3	cdc	EPA 160.2	
Total Organic Carbon (TOC)		12		mg/L	01/19/2001		1393	<1	jmg	SM 5310 B.	
ICP DISSOLVED METALS		Complete			01/22/2001		527	Complete	rrs	EPA 200.7	
Iron, Dissolved, ICP		<0.10		mg/L	01/22/2001		601	<0.10	rrs	EPA 200.7	
Sample Filtration		Complete			01/19/2001		305	Complete	emd		
BTEX 8020, AQUEOUS											
Benzene		60.6		ug/L	01/24/2001		565	<10	mcb	SW 8020	
Ethylbenzene		<10		ug/L	01/24/2001		565	<10	mcb	SW 8020	
Toluene		<10		ug/L	01/24/2001		565	<10	mcb	SW 8020	
Xylenes, Total		<10		ug/L	01/24/2001		565	<10	mcb	SW 8020	
Surrogate: BPB		96		%	01/24/2001		565		mcb	SW 8020	

ANALYTICAL REPORT

Cindy Edgington
LOCKWOOD, JONES & BEALS

01/25/2001

PO BOX 20246
Dayton, OH 45420-0246

Job Number: 01.00353

Client Project ID: DP&L/Dryden Rd.EN-16807.A4

SAMPLE NO.	SAMPLE DESCRIPTION	DATE ANALYZED	Result	Flag	Units	Prep	Run	Reporting Limit	Analyst Initials	Method Reference
						Batch Number	Batch Number			
657076	GW-1-Grab									DATE/TIME TAKEN 01/17/2001 10:45
Nitrogen, Ammonia Direct	0.28	mg/L	01/23/2001			1139		<0.05	kkh	EPA 350.1
Phosphate, Ortho	<0.306	mg/L	01/19/2001			411		<0.306	cca	SM 4500-P E.
Solids, Suspended	37	mg/L	01/18/2001			2367		<3	cdc	EPA 160.2
Total Organic Carbon (TOC)	7	mg/L	01/19/2001			1393		<1	jmg	SM 5310 B.
ICP DISSOLVED METALS	Complete		01/22/2001			527		Complete	rrs	EPA 200.7
Iron, Dissolved, ICP	<0.10	mg/L	01/22/2001			601		<0.10	rrs	EPA 200.7
Sample Filtration	Complete		01/19/2001			305		Complete	emd	
BTEX 8020, AQUEOUS										
Benzene	96.5	ug/L	01/24/2001			565		<10	meb	SW 8020
Ethylbenzene	<10	ug/L	01/24/2001			565		<10	meb	SW 8020
Toluene	<10	ug/L	01/24/2001			565		<10	meb	SW 8020
Xylenes, Total	<10	ug/L	01/24/2001			565		<10	meb	SW 8020
Surrogate: BFB	98	%	01/24/2001			565			meb	SW 8020

QUALITY CONTROL FLAG DEFINITIONS

Job Number: 01.00353

(*) Indicates an out-of-control QC. The analytical data was reported based on other supporting quality control information.

(Note) Indicates to review the notes and comments section of the analytical report as there is additional information concerning this analytical result.

(MS) Indicates that the Matrix Spike (MS) was out of statistical advisory limits.

(MSD) Indicates that the Matrix Spike Duplicate (MSD) was out of statistical advisory limits.

(RPD) Indicates that the Relative Percent Difference (RPD) for the MS/MSD pair was outside of statistical advisory limits.

(SS) Indicates that the MS and MSD were out of statistical advisory limits.

(SSR) Indicates that the MS, MSD and RPD were out of statistical advisory limits.

(MSR) Indicates that the MS and RPD were out of statistical advisory limits.

(MSDR) Indicates that the MSD and RPD were out of statistical advisory limits.

(DL) Indicates that the MS and MSD were diluted out and the percent recoveries of the spikes could not be calculated.

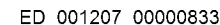
(LS) Indicates that statistical accuracy and precision data is not available for spike concentrations which are $< 1/4$ of the sample amount. Care should be used in interpreting this data.

(J) Indicates estimated concentration due to internal standard areas or surrogate recoveries outside of control limits. A sample matrix effect is usually indicated.

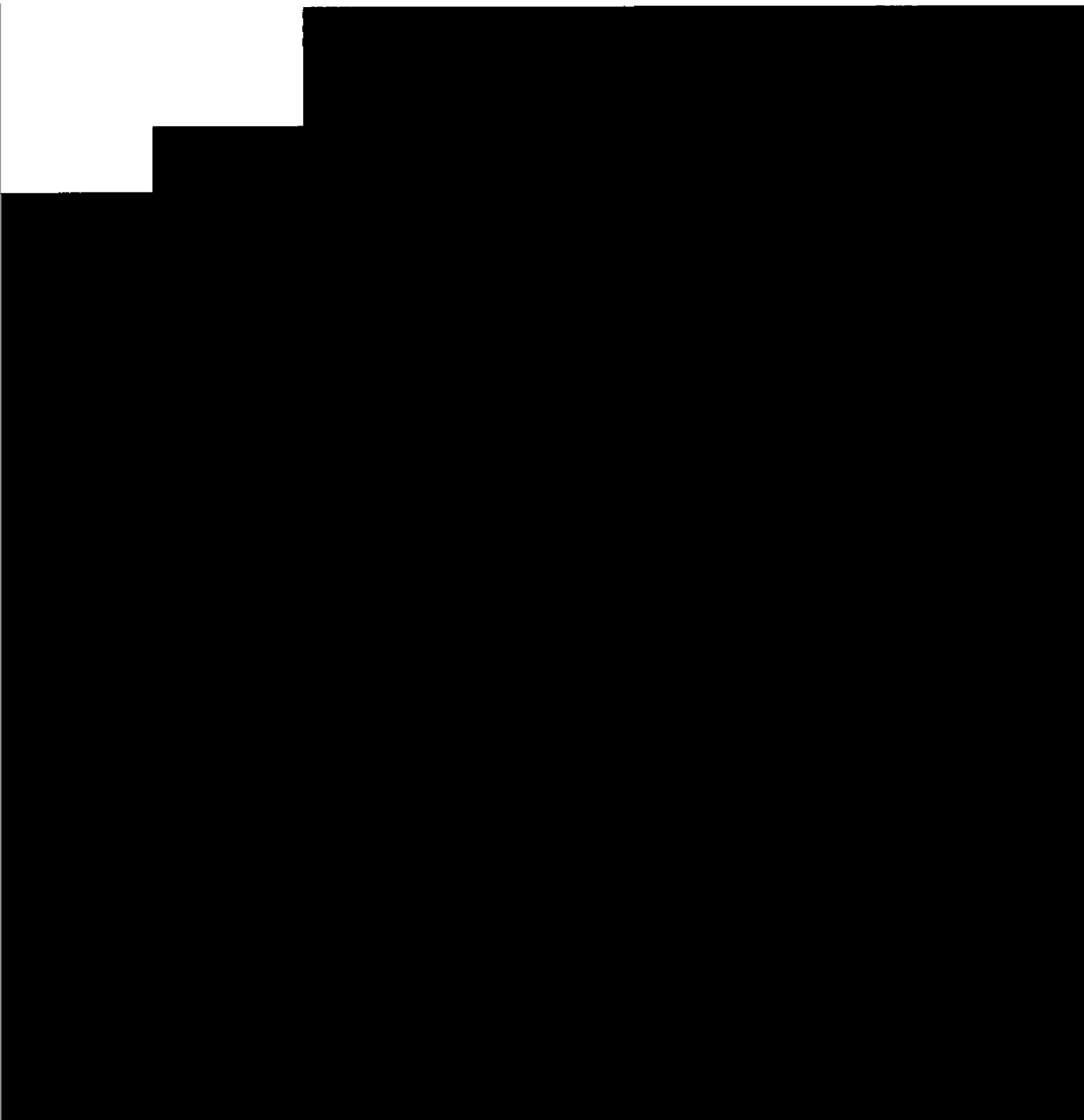
(DW) Indicates Dry Weight.

Analytical Reporting Limits

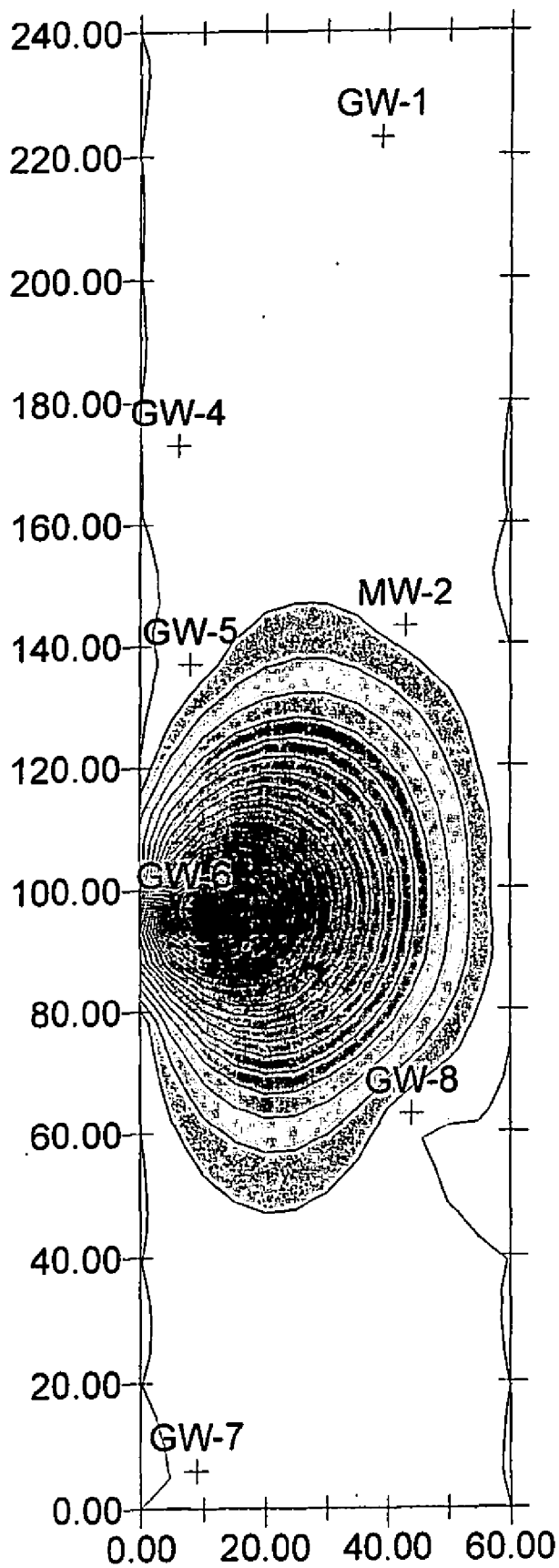
The reporting limits listed for non-aqueous samples in the analytical report section are Practical Quantitation Limits (PQLs). These PQLs are based upon a typical standard weight used for a non-aqueous sample. The reporting limit for a sample may be different from the PQL listed depending upon the actual weight of sample used, the samples moisture content and any dilutions used during the analysis.



APPENDIX B



OP&L BTEX ISOPLETHS - AREA OF REMEDIATION



VOLUME COMPUTATIONS - SUM BTEX REMEDIATION AREA

UPPER SURFACE

Grid File: H:/MISC. SOFTWARE/SURFER6/DPL-SMALL2.GRD
Grid size as read: 13 cols by 50 rows
Delta X: 5
Delta Y: 4.89796
X-Range: 0 to 60
Y-Range: 0 to 240
Z-Range: -64.716 to 5701.39

LOWER SURFACE

Level Surface defined by Z = 5

VOLUMES

Approximated Volume by
Trapezoidal Rule: 6.8225E+006
Simpson's Rule: 6.86272E+006
Simpson's 3/8 Rule: 6.88716E+006

CUT & FILL VOLUMES

Positive Volume [Cut]: 6.83185E+006
Negative Volume [Fill]: 9348.75
Cut minus Fill: 6.8225E+006

AREAS

Positive Planar Area
(Upper above Lower): 13279
Negative Planar Area
(Lower above Upper): 1121.03
Blanked Planar Area: 0
Total Planar Area: 14400

Positive Surface Area
(Upper above Lower): 563040
Negative Surface Area
(Lower above Upper): 6206.98

AVG. BTEX

Positive Volume [Cut]: 6.83185E+006
Positive Planar Area
(Upper above Lower): 13279
Cut/Upper above Lower: 514.48 ppb BTEX